

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

the Application of:

Mena et al.

Docket No.: TI-29612

Serial No.: 09/895,524

Examiner: Greene, P.

Filed: 06/28/01

Art Unit: 2826

For: HDP LINER LAYER PRIOR TO HSQ/SOG DEPOSITION TO REDUCE THE
AMOUNT OF HSQ/SOG OVER THE METAL LEAD

Declaration under 37 C.F.R. §1.131

April 24, 2003

Commissioner of Patents
PO Box 1450
Alexandria, VA 22313-1450

MAILING CERTIFICATE UNDER 37 C.F.R. §1.8(A)

I hereby certify that the above correspondence is being deposited
with the U.S. Postal Service as First Class Mail in an envelope
addressed to: Commissioner for Patents, PO Box 1450, Alexandria,
VA 22313-1450 on

5-16-03

Marianna Smith

Marianna Smith

We hereby declare:

That we are the co-inventors for the above identified patent application;

That we conceived and reduced to practice in the United States the invention
claimed in the above identified patent application prior to August 4, 1999, the filing date of
the cited U.S. Patent No. 6,174,808 to Jang et al. Attached Exhibit A is a copy of dated
records (having the dates removed) relating to this conception and reduction to practice
wherein the use of a HDP liner prior to HSQ/SOG deposition is discussed. Reduction to
practice is evidenced by pages 6-8 of Exhibit A. Pages 6-8 show SEM photographs of a
partially fabricated integrated circuit having an HDP liner layer wherein a portion of the
HDP liner layer over the metal leads has sloped edges, a gap-fill layer (HSQ) filling a

space between closely-spaced leads and a dielectric layer (PETEOS) over the gap-fill layer.

That Exhibit A, which relates to the aforementioned conception and reduction to practice, corresponds to the invention broadly disclosed and claimed in the above-identified patent application.

We further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

5/15/03
Date

Rafael A. Mena
Rafael A. Mena

5/15/03
Date

Philip E. Hecker, Jr.
Philip E. Hecker, Jr.

5/15/03
Date

Alfred J. Griffin, Jr.
Alfred J. Griffin, Jr.

29612
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* TI INVENTION/INNOVATION DISCLOSURE *

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Attn: Agatha Gutierrez PC DROP PCN1

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If you are employed by a TI subsidiary company, send this form to your site coordinator.

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To prepare your invention disclosure, follow the step-by-step directions on the form that follows. Type or print answers to the questions in the spaces provided.

Please provide answers to all of the questions

If you already have an engineering spec, please send it with your invention disclosure. Computer documentation and drawings, marketing foils, notebook entries, paper manuscripts, articles, and any other material that you already have can be copied or sent electronically.

DISCLOSURE FORM FOLLOWS

DOCKET NO. TI 29612

IF ELECTRONICALLY TRANSMITTED, PROCESSING OF YOUR DISCLOSURE
CANNOT BE COMPLETED WITHOUT A FOLLOW-UP COPY SIGNED AND
DATED BY ALL INVENTORS AND AT LEAST ONE WITNESS.

1. Please suggest a descriptive title for your invention:

Use of an HDP (high density plasma oxide) Liner Prior to HSQ/SOG (spin on glass) Deposition to Reduce the Amount of HSQ/SOG over the Metal Lead.

2. What is the problem solved by your invention?

Currently, outgassing of the HSQ/SOG prevents complete filling of the via during tungsten nucleation. The voiding of the via results in open circuits and subsequent lower process and multi-probe yields. This problem is worsened as the HSQ/SOG thickness is increased in order to guarantee adequate gap fill. Increasing the HSQ/SOG thickness in order to fill the gaps between the metal leads results in a "pile-up" of the HSQ thickness on top of the metal lead. When making contact to the metal lead, the increased amount of HSQ/SOG on the metal lead results in more severe outgassing.

3. What is your solution to the problem?

The HDP process consists of both a deposition and a sputter-etch component. The sputter-etch component results in an oxide with a triangular, 45 degree slope sitting on top of the metal lead (please refer to attached SEM x-sections). The HDP oxide profile results in an effective decrease in the metal surface area which limits the amount of HSQ/SOG that is deposited on the lead.

4. When was your solution first conceptually or mentally complete?

Date: _ _ / _ _ / _ _ .

5. What is the first tangible evidence of such completion?

Date: _ _ / _ _ / _ _ .

6. What is different about your solution, compared with other solutions to the same problem?

Other solutions are focused around effectively outgassing the HSQ/SOG prior to via barrier metal processing following the via-etch clean up step.

Outgassing of the HSQ/SOG is carried out by adding a lengthy, high temperature bake. The extended high temperature bake adds a considerable amount of processing time (up to 5 minutes a wafer during barrier metal processing) and significantly impacts the thermal budget for subsequent processing. By adding an HDP liner and reducing the amount of HSQ/SOG over the lead, both the temperature and length of the degas step is significantly decreased. The HDP liner can be further used to replace the current PETEOS oxide liner that is required to protect the metal lead from the same outgassing of the HSQ.

8. What TI products, processes, projects or operations currently implement your invention?
None

10. What record exists to prove this date? Engineering Lot 9120705

13. Has a TI product incorporating the invention been
Publicly introduced, quoted, sampled or shipped? (Y/N) ___ No ___
When? ___ / ___ / _____. If planned--when? ___ / ___ / _____

14. Was the invention conceived or first implemented in
The performance of a government contract or subcontract?
(Y/N) No _____ Contract #:

THE INVENTION DESCRIBED BY THIS DISCLOSURE IS SUBMITTED
PURSUANT TO MY EMPLOYMENT AGREEMENT WITH TEXAS INSTRUMENTS
INCORPORATED OR A TI SUBSIDIARY (SPECIFY):

Has this disclosure been previously sent to the Patent Department electronically
(unsigned)? (Y/N) No

INVENTORS

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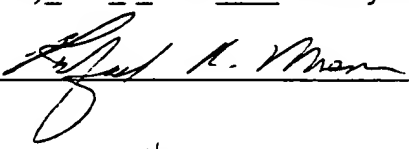
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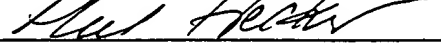
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WITNESSES

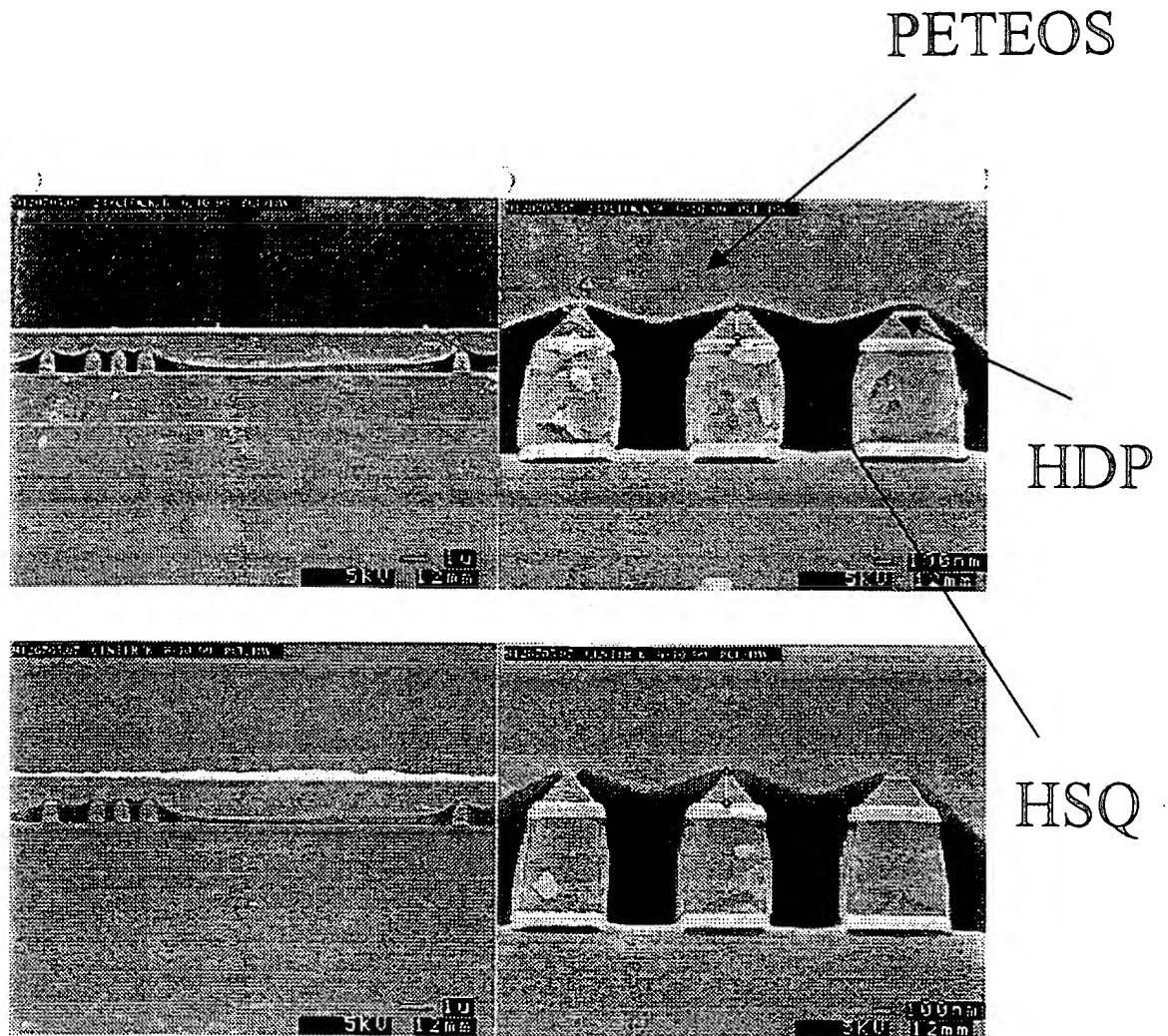
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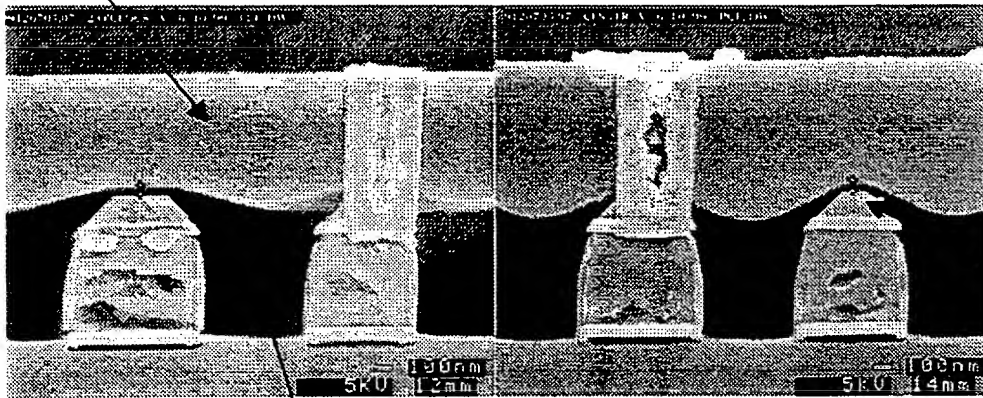
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Witness 2 Date

HDP Liner Prior to HSQ Deposition



HDP Liner Prior to HSQ Deposition

PETEOS

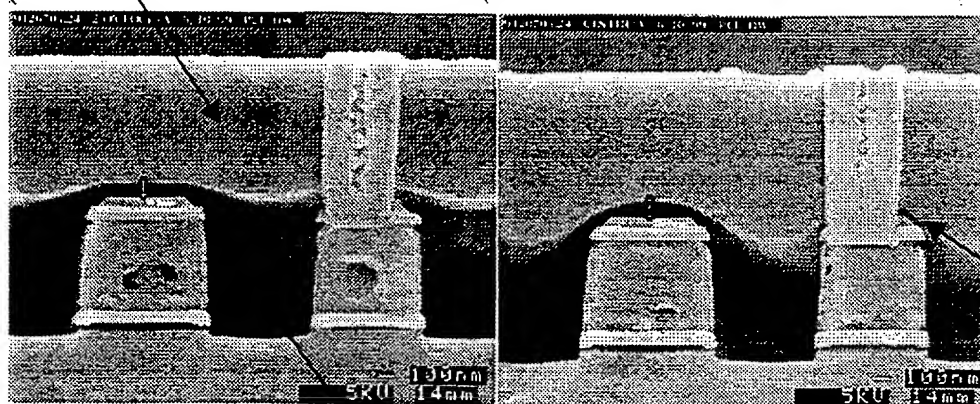


HDP

HSQ

HDP Liner Prior to HSQ Deposition

PETEOS



HDP

HSQ